

ABSTRACT AND BIO-SKETCH

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Lecture Title: Nanomaterials for H₂ storage

Abstract

European and Italian investments plan to support hydrogen as a carrier in the energy transition. After production and before the use in different applications, hydrogen may need to be purified, transported, compressed and stored. Hydrogen is conventionally stored in high pressure gas cylinders and, as a liquid phase, in opened tanks. These methods present several economic and security problems. So, hydrogen storage in liquid or solid carriers is a suitable method for future applications.

Materials to be used as solid-state hydrogen carriers require high mass and volumetric capacity, coupled with a fast kinetics of gas uptake and release. In addition, the reversible hydrogenation reaction should take place close to ambient pressures and temperatures. These properties can be reached when suitable thermodynamic properties are combined with a nanostructure. The lecture will focus on the role of nanostructured materials and of interfaces on thermodynamic and kinetic properties of hydrogen storage materials. In particular, hydrogen absorption and desorption in metal and complex hydrides will be discussed. In order to lower the enthalpy of reaction, reactive hydride composites (RHC), consisting in combining two hydrides, will be also considered. Synthesis is usually performed by ball milling processes, which promote the formation of nanostructures. Structural, microstructural, thermal and volumetric properties are performed by a combination of several experimental techniques (i.e. XRD, SEM-EDS, DSC, TPD, PCI). Examples will be provided (e.g. MgH₂, TiFe, LaNi₅, borohydrides, etc.), including the role of additives in promoting hydrogen sorption reactions. Case studies will be presented, pointing out possible stationary and mobile applications.

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Bio-sketch



Marcello BARICCO obtained the PhD in Chemistry in 1987. He works for the Department of Chemistry of the University of Torino as a full professor in Materials Science and Technology. He has been responsible for the University of Torino in several research projects with European and Italian research institutions and industrial partners (e.g., FLYHY, COSY, BOR4STORE, ECOSTORE). He coordinated the SSH2S European project on hydrogen storage and now he coordinates the EU H2020 project HyCARE, financed by FCH JU. He is an expert in the Task 40 of the IEA-HIA and he is coordinator of SP7 on Hydrogen Handling of JP on Fuel Cells and Hydrogen of EERA. The scientific contributions have been presented in about 390 publications in peer refereed national and international journals with about 5900 citations (h-index 37). A list of published papers can be found at ORCID: www.orcid.org/0000-0002-2856-9894 or ResearchID: www.researcherid.com/rid/B-4075-2013.